Air NSR_100225945-120773_PA_2014 08 22_Agency Review_212406

08/22/2014 ----------NSR IMS - PROJECT RECORD ----------

PROJECT#: 212406 PERMIT#: 120773 STATUS: COMPLETE DISP CODE: _____
RECEIVED: 06/13/2014 PROJTYPE: INITIAL AUTHTYPE: PBR ISSUED DT: 07/29/2014
RENEWAL:
PROJECT ADMIN NAME: R&D B1607 LABOCOMBI EXPERIMENTAL SURFACE COATING FACILITY
PROJECT TECH NAME: DOW TEXAS OPERATIONS

Assigned Team:RULE REG SECTION

STAFF ASSIGNED TO PROJECT:

OYLER , TONI	- REVIEWR1_2 -	AP INITIAL REVIEW
SMILEY , NOELLE	- ADMIN -	AP INITIAL REVIEW
AKINTAN , NANCY	- REVIEW ENG -	RR TEAM
INMAN , ANNE	- PEERREVIEW -	RULE REG SECTION

CUSTOMER INFORMATION (OWNER/OPERATOR DATA)
ISSUED TO: THE DOW CHEMICAL COMPANY
COMPANY NAME: The Dow Chemical Company
CUSTOMER REFERENCE NUMBER: **CN600356976**

RECEIVED
SEP 2 2 2014
TCEQ
CENTRAL FILE ROOM

REGULATED ENTITY/SITE INFORMATION
REGULATED ENTITY NUMBER: **RN100225945** ACCOUNT: BL0082R
PERMIT NAME: DOW TEXAS OPERATIONS FREEPORT

REGULATED ENTITY LOCATION: 2301 N BRAZOSPORT BLVD
REGION 12 - HOUSTON NEAR CITY: FREEPORT COUNTY: BRAZORIA

CONTACT DATA

CONTACT NAME: MS FRAN QUINLAN FALCON CONTACT ROLE: RESPONSIBLE OFFICIAL

JOB TITLE: ENVIRONMENTAL DELIVERY LEADER TEXAS OPERATIONS ORGANIZATION: THE DOW CHEMICAL COMPANY

MAILING ADDRESS: 2301 N BRAZOSPORT BLVD, FREEPORT, TX, 77541-3203
PHONE: (979) 238-9978 Ext: 0
FAX: (979) 238-0317 Ext: 0
EMAIL:TXLES@DOW.COM

CONTACT NAME: MR JAMES DAVENPORT CONTACT ROLE: TECHNICAL CONTACT
JOB TITLE: ENVIRONMENTAL MANAGER TXO R&D GCO ORGANIZATION: THE DOW CHEMICAL COMPANY
MAILING ADDRESS: 2301 N BRAZOSPORT BLVD, B-101, FREEPORT, TX, 77541-3203
PHONE: (979) 238-7877 Ext: 0

FAX: (979) 238-0317 Ext: 0
EMAIL:JDAVENPORT@DOW.COM

PROJECT NOTES:

06/17/2014 DFC 6/17/14. SR DOC 507678.

PERMIT NOTES:

07/28/2014 EMISSIONS FROM PBR SHALL BE INCORPORATED INTO TV PERMIT O2219.

FEE:

Reference	Fee Receipt Number	Amount	Fee Receipt Date	Fee Payment Type
209687		450.00		ePAY

TRACKING ELEMENTS:

TE Name	Start Date	Complete Date
APIRT RECEIVED PROJECT (DATE)	06/13/2014	
APIRT TRANSFERRED PROJECT TO TECHNICAL STAFF (DATE)	06/17/2014	
CENTRAL REGISTRY UPDATED	06/17/2014	06/17/2014
SITE REVIEW RFC SENT TO REGION (DATE)	06/17/2014	
PROJECT RECEIVED BY ENGINEER (DATE)	06/25/2014	
DEFICIENCY CYCLE	06/26/2014	07/23/2014
ENGINEER INITIAL REVIEW COMPLETED (DATE)	06/26/2014	
PEER / MANAGER REVIEW PERIOD	07/25/2014	07/25/2014

PROJECT RULES:

Unit Desc	Rule Desc	Request Type	On Application	Approve
FACILITIES (EMISSION AND DISTANCE LIMITATIONS)	106.262 -	ADD	Y	APPROVE
SURFACE COAT FACILITY	106.433 -	ADD	Y	APPROVE

PERMIT RULES:

Unit Desc	Rule Desc	Start Date	End Date
SURFACE COAT FACILITY	106.433	07/29/2014	
FACILITIES (EMISSION AND DISTANCE LIMITATIONS)	106.262	07/29/2014	

PROJECT ATTRIBUTES:

Attributes	Value
CERT_PI_7	
PROJECT POINT	5.00

July 22, 2014

ELECTRONIC TRANSMISSION **NANCY.AKINTAN@TCEQ.TEXAS.gov**

Nancy Akintan, **MC-163**
Texas Commission on Environmental Quality (TCEQ)
P.O. Box 13087
Austin, TX 78711-3087

THE DOW CHEMICAL COMPANY CN600356976
DOW TEXAS OPERATIONS RN100225945
PBR 106.433: R&D B1607 LABOCOMBI
PBR REGISTRATION - ADDITIONAL INFORMATION

Dear Ms. Akintan:

This submittal includes supplemental information to fulfill your email request from July 14, 2014. You instructed Dow to use PBR 106.262 to authorize installation and operation of the corona discharge unit's ozone emissions which is part of the Labo Combi 400, an experimental surface coating facility at the R&D Building B-1607. This submittal must be combined with the original submittal dated June 5, 2014 to understand the complete PBR project. The attachments are:

- Process Description (unchanged from previous submittal)
- Process Flow Diagram (unchanged from previous submittal)
- §106.262 Demonstration of Compliance (new)
- Table 1 Emission Limits (unchanged from previous submittal)
- Table 2 PBR Compliance Table (expanded to include limits and citations for 106.262.)
- Emission Calculations (expanded for ozone and ammonia to support 106.262 compliance)

This PBR requires written site approval by TCEQ Region XII prior to start of construction. This unit is actually built off-site but Dow is planning to begin installation as soon as it can be scheduled. Your assistance in expediting this PBR claim to achieve that timing is appreciated.

For future correspondence please contact
James Davenport (979) 238-7877 or
FAX (979) 238-0317 or
e-mail jdavenport@dow.com

Sincerely,

James W. Davenport, Environmental Manager TXO-R&D
Bldg. B101

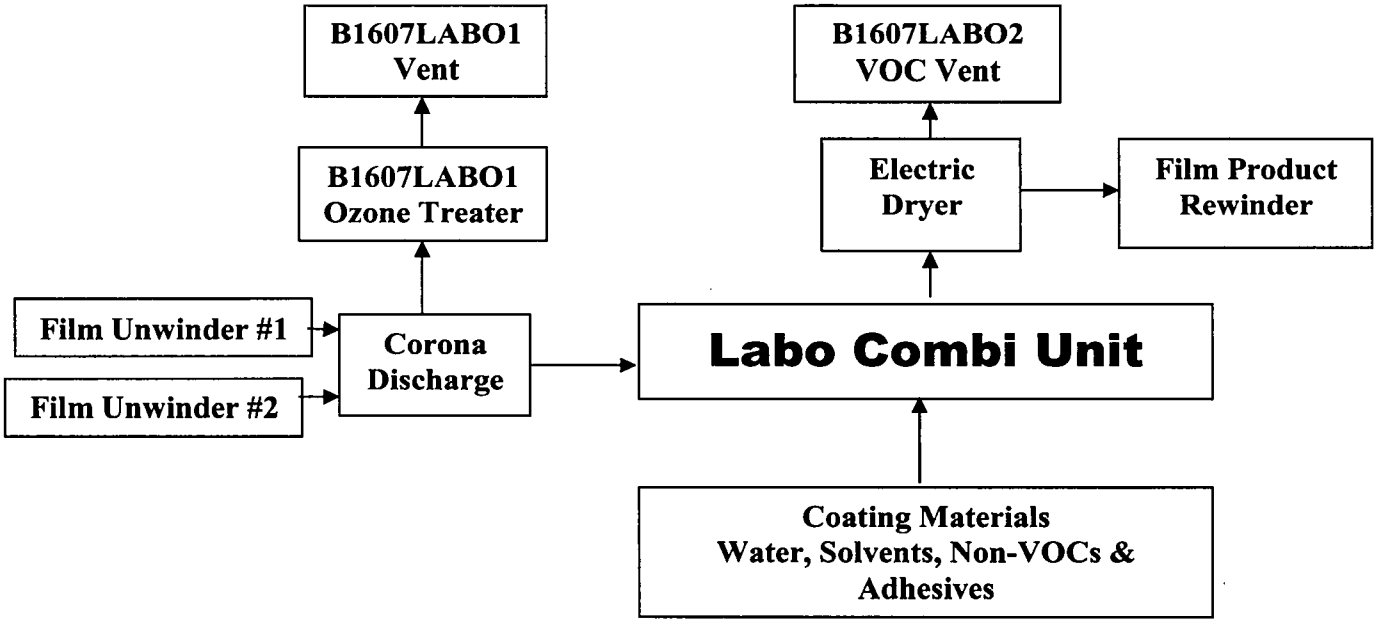
XC:	Manager	Air Section, TCEQ, OCE/FO Region XII 5425 Polk Avenue, Suite H, Houston, TX 77023-1423
	Director	Environmental Health, Brazoria County Health Department, 436 E Mulberry, Angleton, TX 77531
	Amanda Deaver	B-3827
	Georgia Huff	B-1470

B-1607 Surface Coating Process Description

Introduction	The project involves the installation of a pilot laminator for paper and plastic starting in June, 2014. The unit will begin operations in August 2014. The pilot laminator is a research scale version of a film lamination line.
Film feed & treating	Continuous paper or plastic films are unwound through the Labo Combi Unit. As film runs through the unit, its wettability can be increased by corona discharge. The corona discharge generates ozone.
Coating	The films can be coated or laminated using water-based or solvent-based or solventless coatings and adhesives. The coating material is applied by metering rollers.
Lamination	Adhesive coated films can be laminated to another continuous film fed from a second unwinder. The second film can also have its wettability increased by corona discharge.
Drying	Solvents are evaporated in a three stage electric drying oven.
Final Product	The coated or laminated films are rewound.
Ozone Control	Ozone generated by the corona discharge is exhausted through a catalytic ozone decomposer and vented to the atmosphere.
VOC Emissions	Evaporated solvents are exhausted to the atmosphere via a separate blower and vent. VOC emissions are controlled by coating formulations and process rates. At the completion of the run unused coatings and **adhesives** are drained from the feed pan and the pan is cleaned with solvent when necessary.
Compliance Assurance	The physical capacity of this coating system exceeds the emission limits in §106.433. Therefore Dow will be estimating emissions for each individual sample run based on the proposed run parameters prior to making that run. Before the run is actually initiated, Dow will verify that the estimated emissions are within the hourly, five hour, weekly and annual emission limits in the PBR and regulation.

FYI C Project 2124406
Reg. 120773
Dow Chemical Co
Thanks

B-1607 Labo Combi Process Flow Diagram:



§106.262. Facilities (Emission and Distance Limitations).

Compliant with §106.262(a)

Facilities, or physical or operational changes to a facility, are permitted by rule provided that all of the following conditions of this section are satisfied.

This version of §106.262 became effective November 1, 2003.

Compliant with §106.262(a)(1)
YES ☒ **NO** ☐ **NA** ☐

Emission points associated with the facilities or changes shall be located at least 100 feet from any off-plant receptor. Off-plant receptor means any recreational area or residence or other structure not occupied or used solely by the owner or operator of the facilities or the owner of the property upon which the facilities are located.

The Labo Combi 400 including its corona discharge unit is greater than 100 ft from the nearest receptor.

Compliant with §106.262(a)(2)
YES ☒ **NO** ☐ **NA** ☐

New or increased emissions, including fugitives, of chemicals shall not be emitted in a quantity greater than five tons per year nor in a quantity greater than E as determined using the equation E = L/K and the following table.

E = maximum allowable hourly emission, and never to exceed 6 pounds per hour.
L = value as listed or referenced in Table 262
D = distance to the nearest off-plant receptor.
K = value from the table on this page. (interpolate intermediate values)

E values for all applicable compounds are calculated on the PBR Compliance Table 2.

D, Feet	K	D, feet	K	D, feet	K	D, feet	K
100	326	400	104	700	54	1,000	34
200	200	500	81	800	46	2,000	14
300	139	600	65	900	39	3,000+	8

Continued on next page

§106.262. Facilities (Emission and Distance Limitations)., Cont.

Compliant with §106.262(a)(3)
YES ☒ NO ☐ NA ☐

Notification must be provided using Form PI-7 within ten days following the installation or modification of the facilities. The notification shall include a description of the project, calculations, and data identifying specific chemical names, L values, D values, and a description of pollution control equipment, if any.

Notification using PI-7 CERT is provided.

Compliant with §106.262(a)(4)
YES ☒ NO ☐ NA ☐

The facilities in which the following chemicals will be handled shall be located at least 300 feet from the nearest property line and 600 feet from any off-plant receptor and the cumulative amount of any of the following chemicals resulting from one or more authorizations under this section (but not including permit authorizations) shall not exceed 500 pounds on the plant property and all listed chemicals shall be handled only in unheated containers operated in compliance with the United States Department of Transportation regulations (49 Code of Federal Regulations, Parts 171-178). Containers of these chemicals may not be vented or opened directly to the atmosphere at any time.

This project will not increase the cumulative amount of any of the following chemicals on site.

☐ acrolein	☐ diazomethane	☐ hydrogen sulfide	☐ ozone
☐ allyl chloride	☐ diborane	☐ ketene	☐ pentaborane
☐ anhydrous ammonia	☐ diglycidyl ether	☐ methylamine	☐ perchloromethyl mercaptan
☐ arsine	☐ dimethylhydrazine	☐ methyl bromide	
☐ boron trifluoride	☐ ethyleneimine	☐ methyl hydrazine	☐ perchloryl fluoride
☐ bromine	☐ ethyl mercaptan	☐ methyl isocyanate	☐ phosgene
☐ carbon disulfide	☐ fluorine	☐ methyl mercaptan	☐ phosphine
☐ chlorine	☐ Anhydrous formaldehyde	☐ nickel carbonyl	☐ phosphorus trichloride
☐ chlorine dioxide	☐ hydrogen bromide	☐ nitric acid	☐ selenium hexafluoride
☐ chlorine trifluoride	☐ hydrogen chloride	☐ nitric oxide	☐ stibine
☐ chloroacetaldehyde	☐ hydrogen cyanide	☐ nitrogen dioxide	☐ sulfur dioxide (liq.)
☐ chloropicrin	☐ hydrogen fluoride	☐ oxygen difluoride	☐ sulfur pentafluoride
☐ chloroprene	☐ hydrogen selenide	☐ tellurium hexafluoride	

Compliant with §106.262(a)(5)
YES ☒ NO ☐ NA ☐

For physical changes or modifications to existing facilities, there shall be no changes or additions of air pollution abatement equipment.

No air pollution control equipment related to existing facilities will be changed or added by this project.

Compliant with §106.262(a)(6)
YES ☒ NO ☐ NA ☐

Visible emissions, except uncombined water, to the atmosphere from any point or fugitive source shall not exceed 5.0% opacity in any five-minute period.

This project will not cause visible emissions to exceed 5% opacity.

Compliant with §106.262(b)
YES ☒ NO ☐ NA ☐

The following are not authorized under this section except as noted in subsection (c) of this section:
(1) construction of a facility authorized in another section of this chapter or for which a standard permit is in effect; and
(2) any change to any facility authorized under another section of this chapter or authorized under a standard permit.

The facilities constructed or changed with this project are not authorized under another permit by rule or standard permit.

Continued on next page

§106.262. Facilities (Emission and Distance Limitations)., Cont.

Compliant with §106.262(c)

YES	NO	NA
☐	☐	☒

If a facility has been authorized under another section of this chapter or under a standard permit, subsection (a)(2) and (3) of this section may be used to qualify the use of other chemicals at the facility.

This section is not necessary for this registration.

Emission Limit Summary Table 1

FIN	EPN	Name	Air Contaminant	Final Limit	
				lb/hr	T/yr
B1607LABO	B1607LABO1	Ozone Treater Vent	Ozone	0.01	0.01
	B1607LABO2	Labo Combi VOC Vent	Ammonia	0.39	0.01
	B1607LABO2	Labo Combi VOC Vent	Total VOC	29	1
	B1607LABO2	Labo Combi VOC Vent	Exempt Solvents	5	10

Table 2 PBR 106.262 Compliance

EPN	Air Contaminant	Project Increase		TLV	PBR Limit		Limit Citation	In Compliance
		lb/hr	T/yr	mg/m3	lb/hr	T/yr		
B1607LABO1	OZONE	0.01	0.01					
	Total OZONE	**0.01**	**0.01**	0.1	**0.01**	**0.03**	106.262(a)(2)	**YES**
B1607LABO2	AMMONIA	0.39	0.01					
	Total AMMONIA	**0.39**	**0.01**	17.0	**1.16**	**5.00**	106.262(a)(2)	**YES**
B1607LABO2	VOC							
	Total VOC	**29.00**	**1.00**	NA	**30.00**	**25.00**	106.433(4)	**YES**
B1607LABO2	Exempt Solvents							
	Total Exempt Solvents	**5.00**	**10.0**	NA	**5.00**	**10.00**	106.433(4)	**YES**
	Grand Total VOC		**1.00**			**5**	106.4(a)(2)	**YES**

B1607 is 1,970 ft. from the nearest off-site receptor.
Therefore in 106.262 the value for K is 15

Emission Calculations

Emission Calculations

FIN **B1607LABO**
EPN **B1607LABO1**

BASIS FOR CALCULATIONS

- Ozone produced by corona treaters is a data extremely variable depending on environmental condition (temp, humidity, etc), power & exhaust fan capacity.
- The outlet emission range is 5-50 ppm with an average value between 20ppm and 40 ppm.
- 1ppmv=2mg/m3 [mg/m3 = (ppm * Mol weight) /24.5], mg/m3 = 1 * 48 / 24.5 = 1.96 mg/m3/ppmv
  Equation taken from ACGHI booklet for 1997TLVs and BEIs, page 10.
- **Pre-control Ozone lb/hr = 50 ppmv * 1.96 mg/m3 / ppmv * (volumetric flow rate per treater) 600 m3/hr * no. of Treaters 2/ 1,000 mg/g / 454 g/lb = Pre-control ozone rate = 0.259 lb/hr**
- **Maximum ozone emission rate = uncontrolled ozone emission rate (0.259 lb/hr) * (1 – DRE) = 0.005 lb/hr**
- **Annual ozone emission rate, T/yr = max hourly rate * hours/yr / 2000 lb/T**

Worst Case Ozone Composition	50	ppm
Conversion Factor	1.96	(mg/m3)/ppm
Blower Exhaust per Treater	600	m3/hr
Treaters on Labo Combi 400	2	
Total Air Flow rate	1200	m3/hr
Pre-control Emission Rate	0.259259	lb/hr
DRE	98.0%	
Operating Hours	2000	hr
Emissions	**lb/hr**	**ton/yr**
	0.005	**0.005**

Emission Calculations

FIN **B1607LABO**
EPN **B1607LABO2**
Ammonia Emissions

Basis of Calculations

- Based on 100% emission of all the ammonia added to the unit for a maximum worst case
- Based on 1, 000 reams of products which utilize ammonia per year
- Coating rate, ream/hr = Linear production rate (820 ft/min*60 min/hr) * width (1.313 ft) / area/ream (3,000 ft^2 / ream) = 21.53 ream/hr
- Adhesive rate lb/hr = Adhesive formulation (3 lb/hr/ream) * Reams/hr (21.53) = 64.58 lb adhesive/hr
- **Ammonia rate lb/hr = Adhesive rate 64.58 lb/hr * Ammonia % in Adhesive (0.6%) / 100% = 0.387 lb/hr = ammonia utilized = ammonia emitted**
- **Ammonia rate T/yr = Ammonia rate lb/hr (0.387) * Reams / yr (1,000) / Reams/hr (21.53) / 2000 lb/T = 0.009 T/yr**

ft^2/ream	3000.0	ft^2/ream
Short term linear production rate	820.0	ft/min
Long term production rate	1000	Reams / yr
Web width	1.313	ft
Coating Speed	21.53	ream/hr
Maximum Adhesive Formulation	3	lb/ream
Maximum ammonia concentration in adhesive	0.60	%
Adhesive Application Rate	64.58	lb/hr
	lb/hr	**T/yr**
Ammonia Emission Rate	**0.387**	**0.009**

Emission Calculations

FIN B1607LABO
EPN B1607LABO2

OVERALL EMISSION CALCULATION BASIS:

The equipment has the physical capacity to exceed the certified emission limits, so compliance with the PBR limits must be documented prior to each run based on the controllable parameters. The emissions from the operation of the Labo Combi are directly affected by the controllable parables below:

CONTROLLABLE COATING PARAMETERS

1. linear velocity of the film, (**Velocity** ft/min)
2. physical width of the film, (**Width** ft.);
3. Physical length of the sample film, (**Length** ft.)
4. Adhesive loading (**Lr** lb/ream of adhesive solids. The solvent is excluded from this term.)
5. Percent of solids in the adhesive formulation, **Xsolids%**= (lb solids / lb of adhesive formulation * 100%)

CALCULATED COATING VALUES BASED ON CONTROLLABLE PARAMETERS

6. Area to be coated per run **Area** (ft^2/run) = **Length** ft/run * **Width** ft = ft^2 /run
7. Adhesive loading per square ft. **Lf** lb/ft^2) = **Lr** (lb/ream) / ft^2/ream (one ream is 3,000 square feet) = lb/ft^2
8. Adhesive use per run, **Adhesive** (lb/run) = **Lf** (lb/ft^2)* **Area** (ft^2/run) = lb/run
9. Percent solvent in the formulation, **F = (100%-Xsolids%)**. Because X + (100-X) = 100
10. Solvent use per run = **Solvent** (lb/run) = **(F% / Xsolids% *Adhesive** lb/run
11. Add cleaning emissions to the solvent use for the complete run emissions.

BASIC PROCEDURE

1. Enter the controllable parameters for the new sample run into the electronic log book
2. Calculate the predicted emissions from the new sample run.
3. Verify that the five hour emission history has adequate space remaining to accommodate the proposed sample run. The five hour rolling average limits for VOCs and exempt solvents are found in §106.433(4). The proposed sample run may need to be delayed until the emission history has adequate space. No single run is allowed to exceed the 29 lb/hr VOC limit or the
4. Conduct the sample run according to the input parameters.
5. Clean the unit to prepare for the next run.

OPERATIONAL MODES

Typically we will make short runs, 100 ft to 200 ft, at slow speed, 50 fpm to 100 fpm. However, several combinations of shorter runs with faster speeds or longer runs with slower speeds along with variations in amounts and types of adhesives and solvents are needed. Since we are not running a production process there is no "normal" run. It's really a true R&D and product development machine. Runs will be dictated by data needs rather than by product demand. Calculations for each run which are completed prior to the run will be used to maintain compliance.

Emission Calculations, co[illegible]ued

FIN **B1607LABO**
EPN **B1607LABO2**

The table below provides examples of emission est[illegible]es for differ[illegible]ypes of [illegible]uns. Actual emissions will be estimated in the electronic logbook prior to making the individual runs to ensure compli[illegible]with hourly, [illegible]e hour average and annual emission limits for VOCs and exempt solvents.

Data Descriptions	Normal Range Operating Range		High Adhesive Loading	Long Run	High Speed Run
	Low	High			
CONTROLLABLE PARAMETERS					
Film Rate, **Velocity**	50 ft/min	100 ft/min	50 ft/min	200 ft/min	800 ft/min
Web Width, **Width**	1.0 ft	1.3 ft	1.0 ft	1.0 ft	1.0 ft
Sample run Length, **Length**	200 ft	200 ft	200 ft	5000 ft	1600 ft
Adhesive Loading, **Lr** (lb adhesive solids/ream) (solvents are excluded)	1 lb/ream	3 lb/ream	6 lb/ream	3 lb/ream	3 lb/ream
Adhesive Formulation Solids, **Xsolids %** (% solids in adhesive formulation)	45%	25%	25%	35%	35%
CALCULATED VALUES BASED ON PARAMETERS					
Adhesive Formulation Solvent, **F%**(% solvent in the formulation(100%-Xsolids%)	55%	75%	75%	65%	65%
Area to be coated per run **Area** (ft^2/run)	200	262.5	200	5000	1600
Adhesive loading per square ft. **Lf** lb/ft^2)	0.0003	0.0010	0.0020	0.0010	0.0010
Adhesive use per run, **Adhesive** (lb/run)	0.067	0.263	0.400	5.000	1.600
Percent solvent in the adhesive formulation,	55%	75%	75%	65%	65%
Solvent use per run = **Solvent** (lb/run)	0.081	0.788	1.200	9.286	2.971

NOTE: For compliance demonstration purposes, the solvent must be speciated between VOCs and exempt solvents

Emission Calculations

FIN B1607LABO

EPN B1607LABO2

Sump Rinse Emissions

CALCULATION BASIS

The sump cleaning is not simultaneous with the operation of the Labo Combi, and its hourly emission rates are less than the hourly emission rates of the Labo Combi; therefore, change is required in the hourly emission rate limits. The annual emissions from rinsing the sump must be added to the operating emissions from the Labo Combi to comply with the certified annual emission limit of 1 T/yr. These example calculations will not affect the emission limits or PBR compliance because those limits are set by this certification. Labo Combi operations including the rinse emissions will be constrained to comply with the registration and all applicable rules.

After each sample run the adhesive formulation is drained from the coating sump and sealed in a container. The metering rollers and coating sump are rinsed with solvent to clean any residual adhesive from the equipment. The rinse solvent collects in the coating sump forming a pool with an area of about 2 square feet. After 10 minutes of rinsing the solvent is drained from the coating sump and sealed in a container. During the cleaning process a portion of the solvent evaporates from the pool and is exhausted from the pilot laminator.
The vaporization rate from a pool can be estimated by the following equation:

$$E_n\text{-}i = M_i * K_i * A * P / R * T \qquad \text{Eq. 3-24}$$

where:

M_i = molecular weight of the liquid
K_i = mass transfer coefficient
A = area of liquid pool
P = vapor pressure of saturated liquid
R = ideal gas constant
T = temperature of liquid

The mass transfer coefficient can be estimated by the following equation:

$$K_i = K0\ (M0/Mi)^{(1/3)} \qquad \text{Eq. 3-27}$$

where:

K_0 = mass transfer coefficient of reference compound.
M_0 = molecular weight of reference compound.
M_i = molecular weight of reference compound.

From

Methods of Estimating Air Emissions from Chemical Manufacturing Facilities, August 2007
prepared by
Mitchell Scientific, Inc, Westfield, NJ, RTI International, Research Triangle Park, NC

Emission Calculations

FIN **B1607LABO**

EPN **B1607LABO2**

Sump Rinse Emissions, continued

Parameter	Value	Units	Value	Units	Comment	
K0	0.83	cm/s	98.031	ft/hr	Mass transfer coefficient of reference compound, water	
M0	18.02	lb/lb-mole			Molecular weight of reference compound, water	
R	998.9	ft3 mmHg/lb-mole K			Ideal Gas Constant	
A	2	ft2			Surface area of solvent pool.	
T	25	C	298.15	K	Temperature of liquid pool.	
t	0.167	hr			Evaporation time	

Solvent	Molecular Weight	Mass Transfer Coefficient	Saturation Pressure	Rinse Time	Evaporation Rate	Evaporated Mass
Units	**lb/lb-mole**	**ft/sec**	**mmHg**	**hr**	**lb/hr**	**lb**
Equations	Mi	$K_i = K_0 * (M_0/M_i)^{**}1/3$	P	t	$E_i = M_i * K_i * A * P / (R*T)$	$Mass = E_i * t$
[1]1,3-Dioxolane	74	61	100	0.167	3.05	0.51
[1]2-Butoxyethanol	118	52	1	0.167	0.04	0.01
[2]Acetone	58	66	231	0.167	5.97	1.00
[1]Ethanol	46	72	59	0.167	1.32	0.22
[1]Ethyl Acetate	88	58	93	0.167	3.18	0.53
[1]Isopropanol	60	66	45	0.167	1.20	0.20
[1]Methanol	32	81	126	0.167	2.20	0.37
[1]Methy Ethyl Ketone	72	62	92	0.167	2.76	0.46
[1]n-Propyl Acetate	102	55	33	0.167	1.26	0.21
[1]Toluene	92	57	29	0.167	1.00	0.17
[1]Shellsol W HT	103	55	40	0.167	1.52	0.25